

OXC = 3132

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April 2, 1962

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MEMORANDUM FOR: Mr. [REDACTED]

SUBJECT: EXPOSURE TO NOISE LEVELS GENERATED BY THE J-58 ENGINE, AND
EAR PROTECTION FROM SAME

1. In February, 1962, when the undersigned was approached regarding possible exposure of personnel to noise levels of 180 decibels (db), (reference paragraph "g", TS-160973) from the J-58 engine, the opinion was expressed that noise levels of this intensity would pose problems which could only be marginally overcome, even with the best personal equipment presently available. Reference paragraph 16 (f), AFR 160-3, which states that "...exposure to noise levels of approximately 150 db may result in disorientation, nausea, vomiting, etc., even if the noise level in the ear canal is below 135 db. Consequently, no one should be exposed, for even a short time, to noise levels that exceed 150 db, no matter how much the noise level in the ear canal has been reduced ...". Also, reference ASTIA Document #244126, which states "...there is a definite limitation to the degree of protection which can be afforded by defenders of the insert or headset type. This limitation is imposed by the fact that airborne sound, when it becomes sufficiently intense, initiates vibrations of the skull which are in turn carried to the cochlea through the bone. They thus bypass the outer and middle ear ...". Maximum attenuations offered by presently available earplug and muff combinations range from 35 db in the 150-300 cycles per second (cps) range to 51 db in the 4000 cps range.

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2. The undersigned contacted the [REDACTED] in February, 1962, in regards to the latest developments in the ear protection field and was informed that the standard V51-R earplug, together with the latest [REDACTED] earmuff, the 372-8-A, or Federal Stock No. 4240-565-0253, offered the maximum attenuation available. The earmuffs, alone, reportedly offer from 18 to 46 db attenuation in the 100-200 cps and the 4000 cps ranges, respectively. The 372-9-A muff offers from 15 db to 46 db attenuation in the 100-200 cps and the 1000 cps ranges, respectively. This attenuation parallels that of the 372-8-A, except for offering somewhat less protection in the lower frequency ranges, but more in the higher frequencies. The muff, 372-8-CM, Federal Stock No. 5965-519-9292, is engineered to operate at noise levels in excess of 145 db, and embodies dynamic microphone and receivers. The [REDACTED] had no figures readily available revealing the attenuation offered by plugs plus the muffs. The V51-R earplugs, if properly fitted, may attenuate as much as 15 or 20 db in the low frequencies and 40 db or more in the high frequencies (reference WADC Tech Report 57-510). The combined use of

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plugs and muffs, however, does not give a cumulative effect equal to the total db attenuation offered by each used separately.

3. On 27 and 28 March 62, the undersigned visited the Bioacoustics Branch, Aeromedical Laboratory, Wright Air Development Center, Wright-Patterson AFB, Ohio, to discuss in detail the human factors' evaluations which were conducted on the J-58 engine by personnel of the Bioacoustics Branch, in 1960. The undersigned met with Lt. Col. Elizabeth Guild, USAF, chief of the Bioacoustics Branch. As a result of this conference, charts, diagrams, and pictures were obtained, substantiating the conclusions which are drawn below. The contour graphs, summarizing the studies, are made a part of the records of the undersigned and as a part of the original of this memorandum; more detailed graphs are a part of the records of the undersigned, and are available to interested participants.

4. The noise surveys on the P & W J-58 engine were conducted 21 Apr 60 - 12 May 60, with sufficient information obtained from these studies to allow comparisons of the J-58, J-57, and J-75 engines as noise sources. Overall and octave band sound pressure levels for the far field, as necessary for air base planning were obtained. The near field sound pressure levels and octave band structure, within 30 feet of the engine center-line, were obtained in part as necessary for evaluation of the noise environment to be encountered by maintenance personnel working in the immediate area of the engine. The results obtained in the test configuration were considered approximately representative of the levels to be obtained with the engine suspended from an aircraft wing in a pod configuration. The results are summarized as contour graphs to give a better visual presentation of the noise field and allow for localization of the various noise sources that combine to produce the total engine noise. Engine power settings utilized for the collection of these data were idle, 10,000 lb., 15,000 lb., military, and after-burner standard thrust settings. These particular settings were chosen to allow for comparison with data presently available for the J-57 and J-75 engines which have military thrust values of 10,000 and 15,000 pounds, respectively. Representative J-57 and J-75 data were included in the study for the purpose of this comparison. Standard procedure for all survey measurements included an acoustical calibration of the microphones before and after each data run to insure accurate knowledge of microphone sensitivities.

5. For the near field surveys, data was presented as contour lines of equal overall sound pressure levels. These contours are constructed on a 5 x 5 foot grid, with distances relative to the center line. Octave band structures are presented for selected near field points -- A7, A10, C3, and CL4. Positions A7 and A10 are representative of engine maintenance positions with A7 being the engine trim position and A10 being 20 feet aft of A7. Position C3 is representative of a position in which ground power equipment will be located. Position CL4 is representative of an

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observer position for engine "eye-lid" operation. Positions A7 and A10 are located 5 feet from the engine center-line, while positions C3 and C14 are 15 feet from the engine center line. Far field data is presented showing sound pressure levels versus angle from the engine intake on a 100 foot radius arc. The data can be extrapolated to distances up to 2000 feet with reasonable accuracy by subtracting 6 decibels for each doubling of the distance from the 100 foot arc.

6. Comparison of the J-58, J-57, and J-75 noise levels for far field was made. It was observed that the noise levels of the J-58 and J-75 engines are comparable. However, the octave band structures differ, with the J-58 exhibiting a greater low frequency energy content. The low frequencies are less seriously affected by atmospheric characteristics, and are attenuated less than the higher frequencies when propagated over large distances. Hence, the low frequencies propagate with losses more nearly representative of the 6 db loss per doubling of the distance. Because of this, it may be expected that the subjective response of the base to the operational use of this engine will differ from that found with the J-75 engine.

7. Lt. Col. Guild considers a V51-R earplug - 372-8-A earmuff combination, if properly fitted and utilized, as adequate protection for the noise levels encountered in this survey, providing discretion is used in limiting the times of exposure of individuals to these noise levels. Equivalent exposure times and limiting equivalent exposure times can be calculated in accordance with AFR 160-3. Other types of earplugs may give equal or better attenuation than the V51-R; for instance, the wax impregnated cotton earplug which is shaped by the wearer to fit his own ear canals may offer 4-6 db more attenuation in some ranges than the V51-R, but has the disadvantage of being soiled too easily by personnel working frequently with fuels, lubricants, hydraulic fluids, etc. The combination of well-fitted insert earplugs and the Air Force muff protectors provides an amount of protection which approaches the limits imposed by the conduction of sound, not through the outer ear, but through the bone and tissue of the head.

25X1A 8. As initial steps in instituting a program to minimize the undesirable effects of noise on the Air Force personnel at the [REDACTED] the following steps will be taken:

25X1A a. Monitoring audiometry - reference audiograms are being made on all personnel at the [REDACTED]. These audiograms will be used in computing the individual's threshold shift. Persons assigned to duty or training involving exposure to hazardous noise will be given a follow up audiogram three months after they enter on such duty and once yearly thereafter. They will receive a final audiogram when their service terminates.

b. Personnel will be indoctrinated in the undesirable effects of noise.

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c. Noisy work areas will be kept under surveillance and will be designated.

d. Personal protective devices, with instructions for proper use and care, will be issued as necessary.

e. Exposures of personnel to intense noise in work areas will be minimized as much as possible.

9. The undersigned was told by Mr. John Parengosky, 29 Mar 62, to discount the noise levels of 180 db reportedly measured by Kelly Johnson (reference TS-160973), which is, in Mr. Parengosky's words, a "seat of the pants guesstimate." For engine run-up, sound diffusers are being installed. The undersigned was told to approach the problem, medically, from the factual figures and material presented by the WADD study. Hence, maximum levels determined ranged around 155 db in a position 5-30 feet aft of the engine, with the afterburner engine setting. Otherwise, the maximum level was 150 db, with the military setting of the engine as shown in the attached contour charts (original copy only). Real-ear attenuation with V51-R earplug and 372-8-A earmuffs are as follows:

<u>Frequency in cps:</u>	<u>Attenuation: (db)</u>
125 (75-150)	37
250 (150-300)	35
500 (300-600)	40
1000 (600-1200)	40
2000 (1200-2400)	39
3000	48
4000 (2400-4800)	51
6000	49
8000 (4800-9600)	45

Thus, it can be seen that the attenuation offered by these combinations will be sufficient to reduce the noise levels to within tolerable ranges. Reference AFR 160-3, which states "...the noise level in the ear canal should never exceed 135 db, no matter how short the exposure period."

10. One additional area which the undersigned was questioned about was the influence of ultrasonics, both physiologically and psychologically. Lt. Col. Guild maintains, and she is in agreement with the statements in WADD-TR-57-510, that there is no reason to fear damages from ultrasonic energy generated by jet engines. Among the reasons given to discount detrimental effects are these:

a. The ultrasonic frequencies present in the vibration spectrum generated by jet engines are far less than are those within the sonic ranges.

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b. Small, fur bearing animals can be killed by exposure to ultrasound in the range of 150 db, but not by the lower intensities of ultrasound present in jet noise spectra;

c. These small furred animals absorb a fairly high proportion of ultrasonic energy, while absorption of high-frequency energy by human skin is relatively very poor. The small animals are not able to dissipate the heat generated on absorption, while the human organism has an efficient heat-regulatory system.

d. Experiments using pure tones of low frequency and bands of noise covering only the sonic range have shown that somatic and mental symptoms identical to those experienced on exposure to jet noise can be aroused by very high intensities of sonic energy. High intensity, rather than high frequency, is the problem.

11. From the studies discussed above, then, it can be ascertained that adequate protection can be offered, provided proper fitting and utilization of currently available equipment is obtained, and provided the figures from the WADD study are valid, rather than the 180 db levels reported by Kelly Johnson.

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7 March 1962

MEMORANDUM FOR : Office of General Counsel/DPD

SUBJECT : OXCART/Sonic Boom Legal Claims, Procedures and Responsibilities

1. I plan to hold a meeting at 1430, 9 March, to discuss and review problems and procedures relating to handling and payment of claims resulting from OXCART sonic booms. Please bone up on this subject for the meeting.

2. In view of the OXCART cover story, I assume that the Air Force will fund and handle claims resulting from OXCART. However, I believe that we should have a written agreement with the Air Force defining our respective responsibilities in this matter.

3. I plan to write Colonel Geary to attend the 9 March meeting as well as appropriate Project Headquarters personnel.

JOHN PARANGOSKY
C/DB/DPD

John Parangosky;C/DB/DPD:haj (7 March 62)

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MEMORANDUM FOR : Special Projects Branch/DPD
SUBJECT : OKCART KC-135 Tanker Support

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During a recent trip to the [REDACTED] 2 March, Mr. C.L. Johnson, in the presence of [REDACTED] informed the undersigned that he could not predict when a KC-135 will be required to support Aircraft #1 flight test operations. However, Mr. Johnson will give Project WGS at least one month's notice prior to requiring tanker support.

SIGNED
JOHN PARANGOSKY
C/DB/DPD

John Parangosky;C/DB/DPD:ha; (7 March 1968)

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6 March 1962

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MEMORANDUM FOR THE RECORD

SUBJECT : H-43B Helicopter for [REDACTED]

REFERENCE : Memo for the Record from DPB/MS, dated 2 March 1962; Same Subject (OXC-3126)

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1. Upon seeing [REDACTED] memorandum of 2 March referenced above, I got in touch with [REDACTED] and told them that I believed it was necessary for us to take extraordinary action to bring about a helicopter capability at the [REDACTED] well in advance of the June or July date forecast in paragraph two of the referenced. Since the H-43B is not only a security surveillance device but an SAR capability, we need to have it in being as early as possible in the flight test program, since an accident requiring its services could take place at any time after first flight.

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2. [REDACTED] will advise me as soon as nominations are received from Air Force for the four positions involved (two pilots, a rotor specialist, and a crew chief), and [REDACTED] will then work with [REDACTED] to see what kind of a quick clearance can be devised on an interim basis, even if it means sending the crew out TTY before all of the background information is available.

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JAMES A. CUNNINGHAM, JR.
Assistant Chief
DPB-DD/P

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